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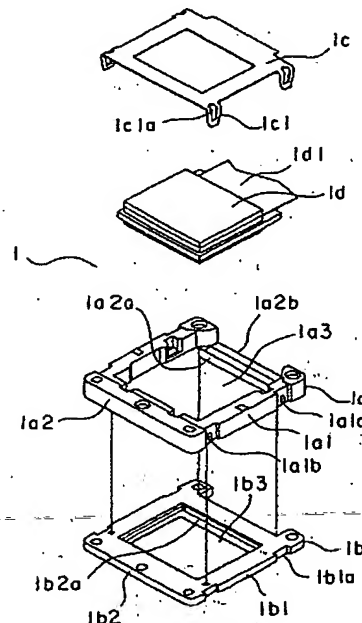
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(54) 【発明の名称】 液晶表示装置

(57) 【要約】

【課題】 伝熱性及び放熱性を向上し、堅牢性、生産性、外観及び価格等の諸点で優れる液晶表示装置を提供する。

【解決手段】 透過型液晶表示装置1は、液晶表示パネル1dと、液晶表示パネルを収容する樹脂製の第1ケース1a及び金属製の第2ケース1bと、見切り板1cとから直方体の形状に構成される。第1ケースには、対向する2辺部1a1の一对の位置決め用凹部1a1aに、それぞれ見切り板の各突出部1c1の孔1c1aに係合する係合凸部1a1bが形成され、他の対向する2辺部1a2に液晶表示パネルを位置決めする位置決め用凸部1a2aが形成される。第2ケースには、対向する2辺部1b2に液晶表示パネルを位置決めする位置決め用凸部1b2aが形成される。第1ケースと第2ケースとは、重ねられて接着剤で固定され、各収容部1a3、1b3に液晶表示パネルが収容される。第1ケースと第2ケースの各3辺部には、放熱フィン (図示せず) が形成される。



【選択図】

図2

(2)

【特許請求の範囲】

【請求項1】

液晶表示パネルと、前記液晶表示パネルを収容するケースと、前記ケースに固定される見切り板とから構成され、前記ケースは、前記液晶表示パネルを位置決めする位置決め部及び前記見切り板と係合する係合部が設けられた樹脂製の第1ケースと、前記液晶表示パネルを位置決めする位置決め部が設けられた金属製の第2ケースとから構成され、

前記第1ケースと前記第2ケースとは、重ねられて固定されることを特徴とする液晶表示装置。

【請求項2】

複数の放熱フィンが少なくとも前記第2ケースに形成されていることを特徴とする請求項1記載の液晶表示装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】

本発明は、液晶表示装置に関し、一例としてプロジェクタ用液晶表示装置に関する。

【0002】

【従来の技術】

従来の透過型液晶表示装置について図8～図10を参照して説明する。

【0003】

透過型液晶表示装置5は、樹脂製のケース5aと、見切り板（遮光板）5bと、液晶表示パネル5cとから直方体の形状に構成される。

【0004】

ケース5aは、長方形の枠状に構成され、対向する2辺部5a1、5a1の外側にそれぞれ一對の位置決め用凹部5a1a、5a1aが設けられ、また、他の対向する2辺部5a2、5a2の内側にそれぞれ位置決め用凸部5a2aが設けられる。各位置決め用凹部5a1a内に、見切り板5b用の係合凸部5a1bが設けられる。ケース5aの中央には、空間が形成され、この空間は液晶表示パネル5c用の収容部5a3となる。2辺部5a2、5a2の一方には、液晶表示パネル5cに接続されるフレキシブル基板5c1用の挿通口5a2bが形成される。

【0005】

見切り板5bは、長方形の枠状に構成され、その4隅にそれぞれ突出部5b1が設けられる。各突出部5b1は、ばね性を有し、下方に折曲され、孔5b1aを設けられている。

【0006】

液晶表示パネル5cは、長方形に構成され、これにフレキシブル基板5c1が接続される。

【0007】

組立方法について説明すると、液晶表示装置の実装ラインで、まず、ケース5aの収容部5a3に液晶表示パネル5cを挿入する。

【0008】

次に、見切り板5bをケース5aに重ねて、見切り板5bの各突出部5b1の孔5b1aをケース5aの各係合凸部5a1bに係合する。すると、組立が完了する。

【0009】

前記透過型液晶表示装置5のケース5aは、樹脂から製造されるが、金属から製造される従来技術も提案されている。

【0010】

図9と図10に、横方向に樹脂又は金属の材料名を、縦方向に物性等を表示した一覧表を示す。

【0011】

ケースがマグネシウム合金から製造される液晶表示装置は、本出願前に知られている（例

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えば、特許文献1参照。)。

【0012】

【特許文献1】

特開2000-194270号公報 (第3頁左欄第5行-第4頁右欄第5行、図1-4)

【0013】

【発明が解決しようとする課題】

従来、プロジェクタ用液晶表示装置には、最初樹脂製ケースが使用されていたが、光源ランプの高出力化対応や液晶表示パネルの長寿命化を目指して金属製ケースの使用が増加している。金属製ケースには、アルミニウム合金、マグネシウム合金又は鉄-ニッケル合金等の材料が使用され、それぞれダイカスト、熔融金属成形又はMIM (メタル・インジェクション・モールドイング) 等の製法によって生産される。

【0014】

しかし、前記材料と製法には、図9と図10に示されるような性能、生産性及び価格上の問題点がある。

【0015】

アルミニウム合金は熱伝導性に優れるが、線膨張率が大きく、温度変化による液晶表示接着面の破損が懸念される。また、アルミニウム合金は主にダイカストで生産されるが、成形時の材料の流れが表面に現われ易く、外観上の欠点が多かった。

【0016】

マグネシウム合金は、主にチクソモールドイング等の熔融金属成形又はダイカストで生産されるが、アルミニウム合金と同様に性能及び生産性の欠点がある。

【0017】

鉄-ニッケル合金やタングステン等の材料は、MIMで生産する場合が多い。これらの材料は線膨張率に優れるが、概して比重が大きいため機器の軽量化に逆行する。また、MIMは加工費が高価である。

【0018】

また、高熱伝導性の熱可塑性樹脂も開発されているが、一般的に強度に劣り、脆い材質が多く、熱伝導率も金属に劣るため、現状では液晶表示装置のケースには適切でない。

【0019】

そこで、本発明は、前記従来の液晶表示装置の欠点を改良し、伝熱性及び放熱性を向上し、堅牢性、生産性、外観及び価格等の諸点で優れる液晶表示装置を提供しようとするものである。

【0020】

【課題を解決するための手段】

本発明は、前記課題を解決するため、次の手段を採用する。

【0021】

1. 液晶表示パネルと、前記液晶表示パネルを収容するケースと、前記ケースに固定される見切り板とから構成され、前記ケースは、前記液晶表示パネルを位置決めする位置決め部及び前記見切り板と係合する係合部が設けられた樹脂製の第1ケースと、前記液晶表示パネルを位置決めする位置決め部が設けられた金属製の第2ケースとから構成され、前記第1ケースと前記第2ケースとは、重ねられて固定される液晶表示装置。

【0022】

2. 複数の放熱フィンが少なくとも前記第2ケースに形成されている前記1記載の液晶表示装置。

【0023】

【発明の実施の形態】

本発明の液晶表示装置の3つの実施の形態例について説明する。

【0024】

まず、本発明の第1実施の形態例の透過型液晶表示装置について図1と図2を参照して説明する。

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【0025】

透過型液晶表示装置1は、ケース樹脂部1aと、ケース金属部1bと、見切り板（遮光板）1cと、液晶表示パネル1dとから直方体の形状に構成される。

【0026】

ケース樹脂部1aは、長方形の枠状に構成され、対向する2辺部1a1、1a1の外側にそれぞれ一対の位置決め用凹部1a1a、1a1aが設けられ、また、他の対向する2辺部1a2、1a2の内側にそれぞれ位置決め用凸部1a2aが設けられる。各位置決め用凹部1a1a内に、見切り板1c用の係合凸部1a1bが設けられる。ケース樹脂部1aの中央には、空間が形成され、この空間は液晶表示パネル1d用の収容部1a3となる。2辺部1a2、1a2の一方には、液晶表示パネル1dに接続されるフレキシブル基板1d1用の挿通口1a2bが形成される。

【0027】

ケース金属部1bは、長方形の枠状に構成され、対向する2辺部1b1、1b1の外側にそれぞれ一対の位置決め用凹部1b1a、1b1aが設けられ、また、対向する他の2辺部1b2、1b2の内側にそれぞれ位置決め用凸部1b2aが設けられる。ケース金属部1bの中央には、空間が形成され、この空間は液晶表示パネル1d用の収容部1b3となる。

【0028】

見切り板1cは、長方形の枠状に構成され、その4隅にそれぞれ突出部1c1が設けられる。各突出部1c1は、ばね性を有し、下方に折曲され、孔1c1aを設けられている。

【0029】

液晶表示パネル1dは、長方形に構成され、これにフレキシブル基板1d1が接続される。

【0030】

組立方法について説明すると、まず、ケース樹脂部1aとケース金属部1bを別々に供給し、液晶表示装置の実装ラインで、各位置決め用凹部1a1aを各位置決め用凹部1b1aに合致させるようにケース樹脂部1aをケース金属部1bに重ねて接着剤で固定する。

【0031】

あるいは、ケース樹脂部1aとケース金属部1bとを、モールドインにより固定する。又は、ケース樹脂部1aの成形時に、ケース金属部1bを成形金型に入れ一体成形しても、又、熱溶着により一体化して、固定するようにしてもよい。

【0032】

次に、液晶表示パネル1dをケース樹脂部1aの収容部1a3とケース金属部1bの収容部1b3に挿入する。

【0033】

続いて、見切り板1cをケース樹脂部1aに重ねて、見切り板1cの各突出部1c1の孔1c1aをケース樹脂部1aの各係合凸部1a1bに係合し、見切り板1cにより、液晶表示パネル1dをケースに固定する。すると、図1に示されるように、組立が完了する。

【0034】

なお、液晶表示パネル1dは、表示領域とケースの窓枠とが合う位置で位置決めされ、液晶表示パネル1dとケースとの隙間に接着剤を流し込み、液晶表示パネル1dとケースとを固定する場合もある。

【0035】

次に、本発明の第2実施の形態例の透過型液晶表示装置について図3～図6を参照して説明する。第2実施の形態例については、第1実施の形態例と同様な点の説明を省略し、相違する点のみの説明を行う。

【0036】

ケース樹脂部2aの対向する2辺部2a1、2a1と、フレキシブル基板2d1用の挿通口2a2bが形成された辺部2a2の反対側の辺部2a2に、それぞれ多数の放熱フィン2a1c、2a2cを形成する。

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【0037】

同様に、ケース金属部2bの対向する2辺部2b1、2b1と、他の1辺部2b2に、それぞれ多数の放熱フィン2b1c、2b2cを形成する。

【0038】

このように構成すると、液晶表示パネル2dが発生する熱は、透過型液晶表示装置2から各放熱フィン2a1c、2a2c、2b1c、2b2cによって放散を促進される。

【0039】

第2実施の形態例においては、図5に示されるように、組立方法は、ケース樹脂部2aとケース金属部2bを予めモールド成形した後に、液晶表示装置の実装ラインに供給する。

【0040】

続いて、本発明の第3実施の形態例の反射型液晶表示装置について図7を参照して説明する。第3実施の形態例については、第2実施の形態例と同様な点の説明を省略し、相違する点のみの説明を行う。

【0041】

反射型液晶表示装置3は、その性質上、ケース金属部3bには、透過型液晶表示装置2のケース金属部2bに必要とされる空間が形成されていない。

【0042】

【発明の効果】

以上の説明から明らかなように、本発明によれば、次の効果が、奏される。

【0043】

1. ケースは、樹脂製の第1ケースと金属製の第2ケースとから構成されるので、樹脂の材料特性と金属の材料特性とを兼備することができる。

【0044】

2. 液晶表示装置は、伝熱性及び放熱性が向上する。

【0045】

3. ケースは、構造が堅牢となり、また、生産が容易である。

【0046】

4. ケースの外観は、良好であり、また、液晶表示装置のコストは、安価である。

【図面の簡単な説明】

【図1】本発明の第1実施の形態例の液晶表示装置の斜視図である。

【図2】同液晶表示装置の分解斜視図である。

【図3】本発明の第2実施の形態例の液晶表示装置の斜視図である。

【図4】同液晶表示装置の分解斜視図である。

【図5】同液晶表示装置におけるケースの他の組立方法を示す斜視図である。

【図6】同液晶表示装置の3面図であり、(A)は平面図、(B)は正面図、(C)は側面図を、それぞれ示す。

【図7】本発明の第3実施の形態例の液晶表示装置の分解斜視図である。

【図8】従来の液晶表示装置の分解斜視図である。

【図9】従来のケースの材料を横方向に、物性等を縦方向に、それぞれ表示した一覧表である。

【図10】従来のケースの材料を横方向に、物性の諸数値を縦方向に、それぞれ表示した一覧表である。

【符号の説明】

1 透過型液晶表示装置

1a ケース樹脂部

1a1 辺部

1a1a 位置決め用凹部

1a1b 係合凸部

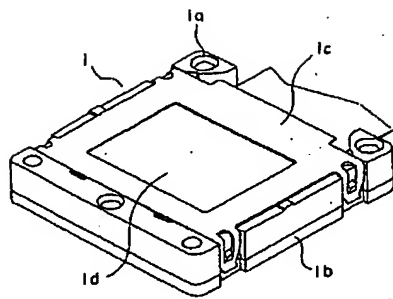
1a2 辺部

1a-2-a 位置決め用凸部

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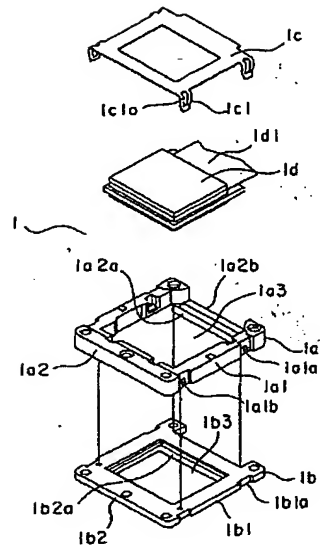
- 1 a 2 b 挿通口
- 1 a 3 収容部
- 1 b ケース金属部
- 1 b 1 辺部
- 1 b 1 a 位置決め用凹部
- 1 b 2 辺部
- 1 b 2 a 位置決め用凸部
- 1 b 3 収容部
- 1 c 見切り板 (遮光板)
- 1 c 1 突出部
- 1 c 1 a 孔
- 1 d 液晶表示パネル
- 1 d 1 フレキシブル基板
- 2 透過型液晶表示装置
- 2 a ケース樹脂部
- 2 a 1 辺部
- 2 a 1 c 放熱フィン
- 2 a 2 辺部
- 2 a 2 b 挿通口
- 2 a 2 c 放熱フィン
- 2 a 3 収容部
- 2 b ケース金属部
- 2 b 1 辺部
- 2 b 1 c 放熱フィン
- 2 b 2 辺部
- 2 b 2 c 放熱フィン
- 2 b 3 収容部
- 2 c 見切り板
- 2 d 液晶表示パネル
- 2 d 1 フレキシブル基板
- 3 反射型液晶表示装置
- 3 a ケース樹脂部
- 3 b ケース金属部
- 3 c 見切り板
- 3 d 液晶表示パネル

【図1】

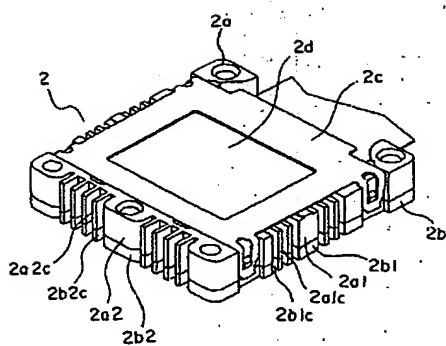


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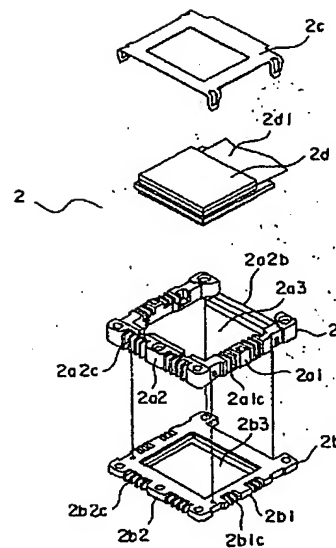
【図2】



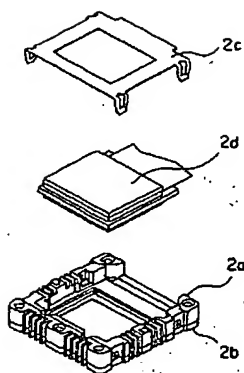
【図3】



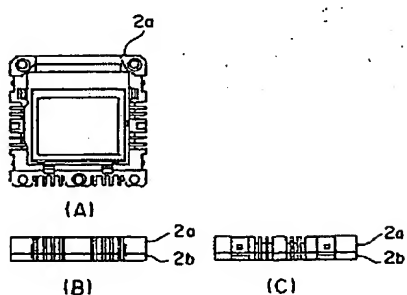
【図4】



【図5】

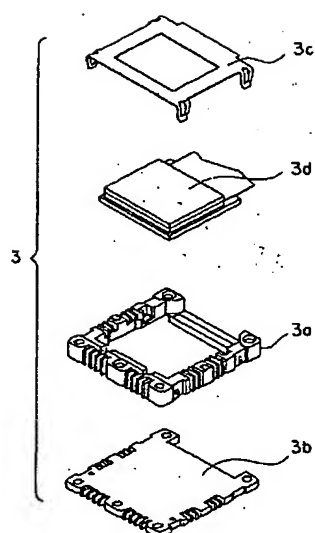


【図6】

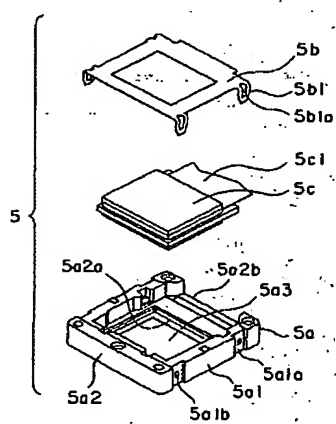


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【図7】



【図8】



【図9】

	樹脂A カーボン (繊維入り/PPS)	樹脂B カーボン (繊維入り/PPS)	マグネシウム 合金	アルミニウム 合金	鉄-ニッケル 合金	タンタムステン 合金	樹脂C(参考) 高強度樹脂
比重	○	○	△	△	×	×	○
製造適性	×	×	○	○	データ無し	○	△
線膨張率	×	○	×	×	○	○	○
強度	△	△	△	○	○	○	×
生産性	○	○	×	×	×	×	△
外観	○	○	×	×	×	×	○
価格	○	○	×	×	×	×	△

※記号説明 ○: 良 △: 使用可 ×: 不可

(9)

【図10】

	樹脂A	樹脂B	マグネシウム 合金	アルミニウム 合金	鉄-ニッケル 合金	タンガスチン	樹脂C(参考) 高熱伝導樹脂
比重(g/cm ³)	1.28	1.4~1.47	1.77~1.81	2.74	8.15	19.3	1.7
線膨張率(10 ⁻⁶ /°C)	22 (縦方向)	6 (縦方向)	25~26	21.8	4.5~5.3	4.6	5 (縦方向)
ヤング率(GPa)	10	20	45	71	150	データ無し	50
曲げ強度(Mpa)	178.5	290	データ無し	データ無し	データ無し	データ無し	180
引張強度(Mpa)	137.3	200	210~230	315	データ無し	データ無し	150
体積膨張率(10 ⁻⁶ /°C)	10 ² ~10 ³	10 ²	12~14×10 ³	27×10 ³	63×10 ³	データ無し	10 ¹
熱伝導率(W/m·K)	データ無し	0.42	72	96	データ無し	166	30

※参考: 石英ガラス線膨張率=0.55×10⁻⁶/°C、炭ガラス線膨張率=8.7×10⁻⁶/°C

(10)

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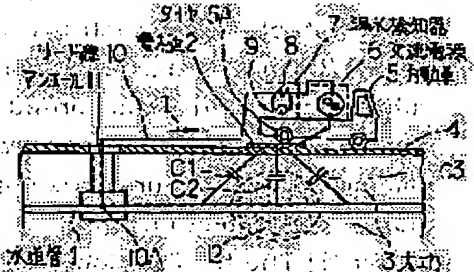
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(54) METHOD AND DEVICE FOR DETECTING WATER LEAKAGE IN WATER SERVICE PIPE

(57)Abstract:

PROBLEM TO BE SOLVED: To detect the leakage of water sensitively in even a paved road, etc., by applying a specified a.c. voltage between an electrode in contact with the ground and a water in a water service pipe and measuring an underground current flowing by the a.c. voltage.

SOLUTION: For example, to detect the leakage of water in a water service pipe 1 in the ground 3 covered with a concrete layer 4, an a.c. power source 6 is connected with an electrode 2 pressed to the ground by an automobile 5 and a lead wire led out from the water service pipe 1 through a manhole 11, etc. The a.c. power source 6 generates, e.g. 1 kHz to 1 MHz a.c. voltage, and a judgement device receives the secondary output of a current transformer 8 in a leakage water detector 7, and measures an underground current I flowing in the lead wire 10. When an area 12 absorbs a water because of leakage of the water service pipe 1, a capacitance C2 becomes large, and the underground current I increases, and a signal is issued to inform of the leakage. If the electrode 2 is arranged to the position out of the directly above part of the pipe 1, the leakage in which absorbing of a water occurs only under the water pipe 1 can be surely detected.



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CLAIMS

[Claim(s)]

[Claim 1] The leakage-of-water detection approach of the water pipe characterized by judging with that to which water is leaking in the water pipe when are the approach of detecting from the ground the leakage of water of the water pipe currently laid underground in the earth, fixed alternating voltage is impressed between the electrode in contact with the earth, and the water within [said] a waterworks, the subterranean current which flows with this alternating voltage is measured and said subterranean current exceeds a predetermined value.

[Claim 2] The leakage-of-water detection approach of the water pipe characterized by being allotted to the location from which said electrode separated from right above the water pipe in the leakage-of-water detection approach of a water pipe according to claim 1.

[Claim 3] The leakage-of-water detection approach of a water pipe that sequential measurement of said subterranean current is carried out meeting and moving said electrode in the die-length direction of a water pipe in the leakage-of-water detection approach of a water pipe according to claim 1 or 2, and said subterranean current is characterized by judging with that to which water is leaking in the water pipe in the largest location.

[Claim 4] The tabular electrode which is equipment which enforces the leakage-of-water detection approach of a water pipe according to claim 1 to 3, and was laid on the surface of the earth, The lead wire with which the edge carried out electric conduction contact with the water within a waterworks on the other hand, and the another side edge was pulled out on the ground through the manhole, The AC power supply which impresses alternating voltage between said electrodes and another side edges of said lead wire, Leakage-of-water detection equipment of the water pipe characterized by being constituted in the leakage-of-water detector judged to be that to which water is leaking in said water pipe when a subterranean current exceeds a predetermined value, while measuring the subterranean current which this AC power supply outputs.

[Claim 5] The tabular electrode which is equipment which enforces the leakage-of-water detection approach of a water pipe according to claim 1 to 3, and was laid on the surface of the earth, The lead wire in which an edge carries out electric conduction contact on the other hand at the metal bibcock or the metallic stop cock of a water pipe, The AC power supply which impresses alternating voltage between said electrodes and another side edges of said lead wire, Leakage-of-water detection equipment of the water pipe characterized by being constituted in the leakage-of-water detector judged to be that to which water is leaking in said water pipe when a subterranean current exceeds a predetermined value, while measuring the subterranean current which this AC power supply outputs.

[Claim 6] Leakage-of-water detection equipment of the water pipe characterized by loading said AC power supply and said leakage-of-water detector into an automobile in the leakage-of-water detection equipment of a water pipe according to claim 4 or 5.

[Claim 7] Leakage-of-water detection equipment of the water pipe characterized by making the tire of said automobile run aground on said electrode in the leakage-of-water detection equipment of a water pipe according to claim 6.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the approach and equipment which catch that a subterranean capacitance component changes especially at the time of leakage of water about the approach and equipment which detect the leakage of water of the water pipe currently laid underground in the earth, and detect leakage of water.

[0002]

[Description of the Prior Art] It is an important technique from when valuing water to detect the leakage of water of a water pipe. However, since the water pipe was laid underground in the earth, it could not view, but the leakage-of-water detection was dramatically difficult. The approach of hearing the sound in which water blows off from a water pipe at the time of leakage of water as the leakage-of-water detection approach of the water pipe currently carried out from the former is taken. That is, since it is sent that the water within a waterworks is also at high voltage, if water leaks, according to the stream in the location, a water pipe will vibrate and an extraordinary noise will occur. The checker recognized this extraordinary noise and the leakage-of-water part was discovered.

[0003]

[Problem(s) to be Solved by the Invention] However, the conventional approach which was mentioned above had the problem that detection sensibility was very bad. That is, the extraordinary noise by leakage of water was unrecognizable unless the checker had become skillful considerably, and even if it was an expert, it might fail to hear an extraordinary noise. Furthermore, when the extraordinary noise at the time of leakage of water was small, it was not able to detect at all. The day ranges when the noise of detection of an extraordinary noise is intense are completely impossible, and were carried out at night. Moreover, a leakage-of-water detection activity was not able to be done in the place from which the noise is free all night long at night. Therefore, conventionally, water has leaked in 10 of tap water thru/or 20%, and water was thrown away vainly.

[0004]

The approach of detecting leakage of water electrically to JP,6-94568,A is indicated. The detection approach of the leakage of water described by this official report is the approach of judging to be that in which water leaked when the subterranean current of a direct current was increased from a value when water is not leaking in a sink and this subterranean current between the electrodes and water pipes which were prepared in earth surface. However, since the subterranean current passed by this approach is a direct current, and resistance of that dry part is extraordinarily high when only the circumference of a water pipe absorbs water selectively and the part from there to an electrode is dry, unless a subterranean current will be in the condition of hardly flowing and between an electrode and water pipes absorbs water extensively, the increment in a subterranean current is not accepted. Since

especially the concrete layer in pavement cannot absorb water easily compared with other soil, the resistance is high. Moreover, since the asphalt layer in pavement cannot absorb water further easily compared with a concrete layer, the resistance is still higher. Therefore, the detection sensibility of leakage of water of this approach was also dramatically bad while applicability was restricted. The object of this invention is to offer the leakage-of-water detection approach and equipment of a water pipe with the high detection sensibility of leakage of water even in pavement.

[0005]

[Means for Solving the Problem] When are the approach of detecting from the ground the leakage of water of the water pipe currently laid underground in the earth according to this invention in order to attain the above-mentioned object, fixed alternating voltage is impressed between the electrode in contact with the earth, and the water within [said] a waterworks, the subterranean current which flows with this alternating voltage is measured and said subterranean current exceeds a predetermined value, it is good to make it judge with that to which water is leaking in the water pipe. Since itself is equipped with the capacitance component, even if between an electrode and the water within a waterworks dries extensively and is in the condition that resistance is high, since a subterranean current is an alternating current, soil and a concrete layer surely flow. On the other hand, if soil absorbs water, since the capacitance will become large, the subterranean current on which it also flows the meantime that water leaked in between an electrode and the water within a waterworks selectively increases. Therefore, even if it is pavement, the leakage of water of a water pipe is detectable with sufficient sensibility.

[0006] Moreover, you may make it allotted to the location from which said electrode separated from right above the water pipe in the approach of starting. By it, even if just under a water pipe absorbs water at the time of leakage of water, a subterranean current comes to increase and the leakage of water of a water pipe can be detected. Moreover, sequential measurement of said subterranean current is carried out meeting and moving said electrode in the die-length direction of a water pipe, and you may make it judge with that to which water is leaking in the water pipe in the location where said subterranean current is the largest in the approach of starting. By it, standardization of the leakage-of-water location of a water pipe can be carried out.

[0007] Moreover, the tabular electrode which is equipment which enforces the approach of starting and was laid on the surface of the earth, The lead wire with which the edge carried out electric conduction contact with the water within a waterworks on the other hand; and the another side edge was pulled out on the ground through the manhole, While measuring the subterranean current which the AC power supply which impresses alternating voltage between said electrodes and another side edges of said lead wire, and this AC power supply output, when a subterranean current exceeds a predetermined value, you may make it constituted by the leakage-of-water detector judged to be that to which water is leaking in said water pipe. The leakage of water of the water pipe of the diameter of macrostomia is detectable with it.

[0008] Moreover, the tabular electrode which is equipment which enforces the approach of starting and was laid on the surface of the earth, The lead wire in which an edge carries out electric conduction contact on the other hand at the metal bibcock or the metallic stop cock of a water pipe, While measuring the subterranean current which the AC power supply which impresses alternating voltage between said electrodes and another side edges of said lead wire, and this AC power supply output, when a subterranean current exceeds a predetermined value, you may make it constituted by the leakage-of-water detector judged to be that to which water is leaking in said water pipe. The leakage of water of the water pipe of the diameter of a header which supplies water to home use is detectable with it.

[0009] Moreover, in this configuration, said AC power supply and said leakage-of-water detector may be made to be loaded into an automobile. The activity which detects leakage of water becomes easy, meeting and moving in the die-length direction of a water pipe by it. Moreover, you may make it make the tire of said automobile run aground on said electrode in this configuration. By it, an electrode can be

pushed on the surface of the earth, being able to apply a fixed load, and the measurement value of a subterranean current is stabilized.

[0010]

[Embodiment of the Invention] Hereafter, this invention is explained based on an example. Drawing 1 is the sectional view showing the configuration of the leakage-of-water detection equipment of the water pipe concerning the example of this invention. The metal water pipe 1 is laid under the interior of the earth 3, and the front face of the earth 3 is covered in the concrete layer 4. The tabular electrode 2 is laid in this concrete layer 4, tire 5A of an automobile 5 takes this electrode 2, and the electrode 2 is pressed to the earth 3 side. On the other hand, it is connected conductively to a water pipe 1 that lead wire 10 is also for node 10A, and it is pulled out through the manhole 11 at the front-face side of the earth 3. AC power supply 6 and the leakage-of-water detector 7 are loaded into the automobile 5. AC power supply 6 generates the alternating voltage of a RF (1kHz thru/or 1MHz), one outgoing end of AC power supply 6 is connected to an electrode 2, and another side is connected to lead wire 10 through the current transformer 8 in the leakage-of-water detector 7. The judgment machine 9 undergoes the secondary output of a current transformer 8, the leakage-of-water detector 7 judges it to be that to which water is leaking in the water pipe 1, when the subterranean current I exceeds a predetermined value, while measuring the subterranean current I which flows to lead wire 10, and it takes out an information signal.

[0011] In drawing 1, if AC power supply 6 is employed efficiently, the subterranean current I will flow between an electrode 2 and a water pipe 1. In that case, since the subterranean current I is high frequency current, the subterranean current I of the value decided by the capacitance $C1$, $C2$, and $C3$ of the concrete layer 4 and the earth 3 etc. flows. Therefore, this subterranean current I flows, even if water is not leaking in the water pipe 1. If water leaked in the water pipe 1, for example, the field [being scattered] 12 has absorbed water, since capacitance $C2$ will become large on the other hand, the subterranean current I judges with that to which water is leaking in increase and the leakage-of-water detector 7, and takes out an information signal. Even if there is leakage of water, the concrete layer 4 cannot absorb water easily, but since it passes that the subterranean current I is also at that capacitance component, this equipment is applicable regardless of the existence of pavement of the earth 3.

[0012] Although the value of the subterranean current I in drawing 1 changes with the burial depth of a water pipe 1, the size of an electrode 2, magnitude V of alternating voltage, and frequencies f . For example, it is the size of 1m and an electrode 2 1m about the burial depth of a water pipe 1. In the condition that there is no leakage of water when it carries out by $V=1kV$ and $f=1kHz$ By $f=1MHz$, I is set to abbreviation $1AV=1V$ by abbreviation $1mAV=1kV$ and $f=1MHz$, I is set to about 1mA by I , and the value of the subterranean current I is in level measurable enough, even if noise voltage has occurred outdoors. In this condition, if leakage of water occurs, it increases several times to the case where there is no leakage of water of the value of the subterranean current I , or becomes large extraordinarily, and the existence of leakage of water can be detected.

[0013] Moreover, the water pipes 1 of the equipment of drawing 1 may be the insulating tubes, such as a product made from vinyl chloride. In that case, what is necessary is just to devise so that electric conduction contact may be carried out to node 10A being about lead wire 10 with the water in a water pipe 1. For example, in the part in which the manhole 11 is established, the current meter, the closing motion bulb, etc. are mostly infixed in the water pipe 1. Mostly, that metal part has exposed this current meter and closing motion bulb to the exterior of a water pipe 1 while touching the water in a water pipe 1. What is necessary is just to set this exposed metal part to node 10A. The insulating water pipe 1 becomes completely equivalent to the metal water pipe 1 electrically, as long as water is flowing inside. Therefore, this equipment is applicable to the component of a water pipe 1 not related at all.

[0014] Furthermore, the equipment of drawing 1 can push an electrode 2 against it by making tire 5A of an automobile 5 run aground on an electrode 2, being able to apply a fixed load to the front face of the

earth 3. When a clearance occurs between an electrode 2 and the front face of the earth 3, the clearance has capacitance. Whenever this clearance is measurement, when it changes, the subterranean current I measured stops stabilizing. On the other hand, with the equipment of drawing 1 , since a fixed load is applied to an electrode 2 with the weight of an automobile 5, the subterranean current I comes to be stabilized. In addition, the automobile 5 is convenient to move the location of an electrode 2 in the die-length direction (longitudinal direction of drawing 1) of a water pipe 1, and measurement of the subterranean current I becomes easy.

[0015] In addition, although the equipment of above-mentioned drawing 1 has the composition of making tire 5A of an automobile 5 running aground on an electrode 2 in order to push an electrode 2 against it on a front face, applying a fixed load to the earth 3 The configuration for pushing an electrode 2 against it for the purpose of making small the clearance between an electrode 2 and the front face of the earth 3 as much as possible, applying a fixed load to the front face of the earth 3 is not limited to the configuration of the equipment of drawing 1 , and can also be considered as a configuration like drawing 2 .

[0016] Drawing 2 is drawing showing the configuration of the leakage-of-water detection equipment of the water pipe concerning the example from which this invention differs, and the sectional view in which (A) shows the configuration of the whole leakage-of-water detection equipment, and (B) are the side elevations showing the configuration of the electrode rise-and-fall section. In (B) of drawing 2 , the electrode rise-and-fall section 20 which makes the base section of an automobile 5 go up and down an electrode 2 is formed. Others of the leakage-of-water detection equipment of drawing 2 are the same as the configuration of drawing 1 . It consists of a control unit 24 prepared in the electrode rise-and-fall section 20 as the guide 21 fixed to the automobile 5 side, the shaft 22 supported possible [sliding of the vertical direction] in the through hole prepared in this guide 21, the actuator 23 which makes the rise-and-fall actuation of this shaft 22 carry out in the vertical direction and an one form with this actuator 23, or another ** type, and the electrode 2 is attached in the soffit of a shaft 22 through the electric-insulation member 25. In addition, that configuration is not limited to the configuration shown in (B) of drawing 2 that this electrode rise-and-fall section 20 should just be what has the function to make it go up and down an electrode 2 in the vertical direction. Moreover, you may make it form this electrode rise-and-fall section 20 in the lateral portion of an automobile 5.

[0017] An actuator 23 performs descent and lifting actuation of a shaft 22 in response to the electrode downward command signal and electrode lifting command signal from a control unit 24. In addition, the sensor which detects that the shaft 22 carried out fixed distance descent caudad from the upper limit location although not illustrated in an actuator 23, Or while establishing the device in which have the sensor which detects that the load more than fixed was applied to the shaft 22, stop downward actuation by the detecting signal from these sensors, and the location of a subterranean current measurement condition is made to stop a shaft 22 It has the sensor which detects the shaft 22 having gone up and having arrived at the upper limit location, and the device in which a shaft 22 is stopped in an upper limit location is established.

[0018] Moreover, an operator's activity will become easier if a control unit 24 is equipped with the control circuit which operates three processes of the output of the electrode lifting command signal to the output and the actuator 23 of a subterranean current measurement command signal to output. / leakage-of-water detector 7 of an electrode downward command signal to an actuator 23 automatically in response to the subterranean current measurement command by the operator for every point of measurement.

[0019] The work habits of the subterranean current measurement by leakage-of-water detection equipment equipped with the electrode rise-and-fall section 20 shown in (B) of this drawing 2 are as follows. In each point of measurement of a subterranean current, an automobile 5 is made to suspend, after that, an electrode 2 is dropped by the electrode rise-and-fall section 20, it pushes against the front face of the earth 3, and a fixed load is applied to an electrode 2. After subterranean current

measurement in this point of measurement is completed, it considers as the condition of having raised the electrode 2 by the electrode rise-and-fall section 20, and having separated from the front face of the earth 3, and an automobile 5 is moved till the next point of measurement.

[0020] In addition, the weight itself can require an automobile 5 for an electrode 2 as a load by dropping an electrode 2 by the aforementioned electrode rise-and-fall section 20, pushing against the front face of the earth 3, and depressing an electrode 2 in the process which applies a fixed load to an electrode 2 to the condition that the end of an automobile 5 is raised from the front face of the earth 3.

[0021] by considering as a configuration like this drawing 2, an automobile 5 is stopped as actuation of the automobile 5 in the activity of leakage-of-water detection in each point of measurement — being sufficient — actuation [as / in the equipment of drawing 1] of riding and carrying out up [of the tire 5A of an automobile 5] on an electrode 2 for every point of measurement becomes unnecessary.

[0022] In addition, in order to prevent that the subterranean current I measured when the clearance between an electrode 2 and the front face of the earth 3 changes stops being stabilized by above-mentioned drawing 1 and the equipment of drawing 2 Although it is the configuration which pushes an electrode 2 against it for the purpose of making small the clearance between an electrode 2 and the front face of the earth 3 as much as possible, applying a fixed load to the front face of the earth 3 If it is made not to change, for example as a configuration like drawing 3 even if it is not such a configuration whenever the clearance dimension between an electrode 2 and the front face of the earth 3 is measurement, it is possible to stabilize the subterranean current I measured.

[0023] Drawing 3 is the side elevation showing the configuration of the electrode rise-and-fall section in the leakage-of-water detection equipment of the water pipe concerning the example from which this invention differs further. In this drawing 3, like drawing 2, while electrode rise-and-fall section 20A which makes the base section of an automobile 5 go up and down electrode 2A is prepared Electrode 2A attached in this electrode rise-and-fall section 20A is equipped with a wheel 27 at those three or more places, respectively, and it is considering as the configuration which leads this electrode 2A by automobile 5 where this electrode 2A is dropped on the front face of the earth 3 by electrode rise-and-fall section 20A. Others of the leakage-of-water detection equipment of drawing 3 are the same as the configuration of drawing 2 including the part which is not illustrated by drawing 3.

[0024] Since the clearance dimension of electrode 2A in the equipment of drawing 3 and the front face of the earth 3 is uniformly maintained by the wheel 27, it can be lost that said clearance dimension changes at every measurement; and the subterranean current I measured can be stabilized.

[0025] Guide 21A fixed to the automobile 5 side as electrode rise-and-fall section 20A of the equipment of drawing 3 was shown in drawing 3, Shaft 22A supported possible [sliding of the vertical direction] in the through hole prepared in this guide 21A, It consists of control unit 24A prepared as an one form or another ** type with actuator 23A which makes the rise-and-fall actuation of this shaft 22A carry out in the vertical direction, and this actuator 23A, and electrode 2A is attached in the soffit of shaft 22A through electric insulation member 25A. Although this electrode rise-and-fall section 20A may be the same as the electrode rise-and-fall section 20 of the equipment of drawing 2, in respect of the function which carries out electrode rise and fall with the equipment of drawing 3 Since it becomes the configuration made to lead by automobile 5 while electrode 2A rotates the wheel 27, where electrode 2A is dropped to the front face of the earth 3 Mechanical association with shaft 22A and actuator 23A

which support electrode 2A after electrode 2A has descended is solved, and shaft 22A is supported for the vertical direction by guide 21A, enabling free sliding. It is made to be in the condition that electrode 2A was always laid on the front face of the earth 3 through the wheel 27 as it is also by the self-weight.

[0026] In addition, in the equipment of this drawing 3, that electrode 2A is led by automobile 5 in the condition of having not carried out rise-and-fall actuation and having always descended on the front face of the earth 3, while performing subterranean current measurement for every point of measurement at the site which performs leakage-of-water detection. Therefore, instead of preparing actuator 23A and control unit 24A in drawing 3 When an operator arrives at the site which performs leakage-of-water

detection, depress shaft 22A by handicraft and electrode 2A is dropped on the front face of the earth 3. When a leakage-of-water detection activity [at the site] is completed, shaft 22A is pushed up by handicraft, and it is good also as a configuration fixed to guide 21A using the member for immobilization which is not illustrated.

[0027] Moreover, with the equipment of drawing 3 , since it is not necessary to stop an automobile 5 for every such subterranean current measurement method, then point of measurement, while it is also possible to measure a subterranean current continuously, and it is possible to shorten the working hours of leakage-of-water detection more, moving electrode 2A continuously by towage by the automobile 5, the location precision in leakage-of-water location standardization can also be raised. However, although that extent changes with conditions of the front face of the earth 3 in the midst which is moving while electrode 2A rotates a wheel 27, since electrode 2A vibrates to it, a noise is overlapped on the subterranean current I measured for the displacement current by the oscillation of this electrode 2A. Therefore, it is better to stop an automobile 5 in each point of measurement, and to have measured the subterranean current like the equipment of drawing 1 and drawing 2 , in order to stabilize measurement of a subterranean current and to make the precision high. In this case, although halt actuation of the automobile 5 in each point of measurement is needed with the equipment of drawing 3 , since the actuation to which it rides and carries out up [of the tire 5A of the automobile / as / in the equipment of drawing 1 / 5] on an electrode 2, or rise-and-fall actuation of the electrode 2 in the equipment of drawing 2 becomes unnecessary, an operator's leakage-of-water detection activity becomes easy.

[0028] Moreover, with the equipment of drawing 3 , since there is a clearance formed of a wheel 27 between electrode 2A and the front face of the earth 3 in a subterranean current measurement condition, when about 1/ of specific inductive capacity of air is set to 5 to it of the earth 3, detection sensitivity falls compared with the case where there are no above clearances. It is good to set up the installation location of the wheel 27 in electrode 2A, and the outer diameter of a wheel 27 in consideration of this point, so that the clearance dimension between the base of electrode 2A and the front face of the earth 3 may become small as much as possible. However, there is a limitation in making said clearance dimension small, and it is necessary to consider as the dimension in consideration of existence of various obstructions, such as a pebble on the front face of the earth 3, with the equipment of drawing 3 . Since it is the configuration of pushing an electrode 2 against it in a subterranean current measurement condition with above-mentioned drawing 1 and the equipment of drawing 2 , applying a fixed load to the front face of the earth 3, and making it the clearance between an electrode 2 and the front face of the earth 3 become small as much as possible on the other hand, it is possible to make detection sensitivity high as compared with the equipment of drawing 3 .

[0029] Drawing 4 is a property diagram at the time of carrying out standardization of the leakage-of-water location of a water pipe 1 using the equipment of drawing 1 thru/or drawing 3 . An axis of ordinate is the subterranean current I, and an axis of abscissa is the location of the die-length direction of a water pipe 1. A characteristic curve 15 is one example by which the subterranean current I was measured, and it turns out that leakage of water has occurred that it is also in the location X where the subterranean current I increases. However, those of width-of-face **X of drawing 4 with extent and the value of the **X of the standardization precision of the leakage-of-water location X are about 10m.

Although it seems that width-of-face **X is large, if it turns out that leakage of water has occurred actually around it, it is enough, and the rest stops feed water and should just dig it up. Namely, what is necessary is just to be able to grasp that leakage of water has occurred certainly within near limits.

[0030] In addition, in case the subterranean current I in each point of measurement is measured while the operator of leakage-of-water detection moves by automobile 5 when carrying out standardization of the leakage-of-water location of a water pipe 1 using the equipment of drawing 1 thru/or drawing 3 , in order for the measurement value to pinpoint the location used as the maximum, it is necessary to measure the subterranean current I in the location of several each before and behind the maximum point. Therefore, actually, after passing the maximum point of the measurement value of the subterranean

current I, it becomes clear that the maximum point suited on the way. Therefore, it becomes possible by putting the mark on the front face of the earth 3 for every measure point of the subterranean current I to pinpoint the location of the maximum point of the measurement value of the subterranean current I in accuracy. As this mark, in the case of the equipment of drawing 1, when a fixed load is applied to an electrode 2 with the weight of an automobile 5 in each point of measurement, the hollow corresponding to the configuration of the electrode 2 formed in the front face of the earth 3 can be used, for example. [0031] Furthermore, in order to do unnecessary the activity of putting a mark on the front face of the earth 3 for every above point of measurement, it can consider as a configuration like drawing 5. Drawing 5 is the block diagram showing the configuration of the part carried in the automobile in the leakage-of-water detection equipment of the water pipe concerning the example from which this invention differs further. With the equipment of this drawing 5, the signal-processing section 31 in which the location and subterranean current measurement value of an electrode create the property data corresponding to 1 to 1, and the display 32 which displays this property data are formed. The part of others of the leakage-of-water detection equipment of drawing 5 is the same as the configuration of drawing 1 including the part which is not shown in drawing 5.

[0032] With the equipment of drawing 5, the speed signal of the automobile 5 picked out from the odometer 33 of an automobile 5 etc. is inputted into leakage-of-water detector 7A, for example. It changes into the positional information of the water pipe die-length direction of an electrode 2 in the signal-processing section 31 prepared in leakage-of-water detector 7A. The location and subterranean current measurement value of the water pipe die-length direction of this electrode 2 create and memorize the property data corresponding to 1 to 1 in the signal-processing section 31. Or a printout is carried out, the display 32 or printers which prepared this property data as a property diagram like drawing 4 as an one form or another ** type with leakage-of-water detector 7A, such as a CRT display, — a display — The operator of leakage-of-water detection enables it to check the location of the maximum point of the measurement value of the subterranean current I with the gestalt of a property diagram.

[0033] Since the location of such a configuration, then the maximum point of the measurement value of the subterranean current I can be read by a display or the property diagram by which the printout was carried out, the activity of putting a mark on the front face of the earth 3 at each point of measurement of the subterranean current I becomes unnecessary; and shortening of the time amount which the improvement in the working efficiency of leakage-of-water location standardization and leakage-of-water location standardization take of it is attained.

[0034] Drawing 6 is the sectional view showing the configuration of the leakage-of-water detection equipment of the water pipe concerning the example from which this invention differs further. The front face of the earth 3 is covered in the concrete layer 13 of pavement. The metal water pipe 1 is laid under one side of the concrete layer 13 of pavement, and the tabular electrode 2 is laid in another one side of the concrete layer 13. This electrode 2 is connected to one outgoing end of AC power supply 6, and the outgoing end of another side of AC power supply 6 is connected to lead wire 10 through the current transformer 8 in the leakage-of-water detector 7. Lead wire 10 is connected conductively to the water pipe 1 through the manhole which is not illustrated. The judgment machine 9 undergoes the secondary output of a current transformer 8, AC power supply 6 generates the alternating voltage of a RF (1kHz thru/or 1MHz), while measuring the subterranean current I which flows to lead wire 10, when the subterranean current I exceeds a predetermined value, it judges the leakage-of-water detector 7 to be that to which water is leaking in the water pipe 1, and it takes out an information signal.

[0035] In drawing 6, if AC power supply 6 is employed efficiently, the subterranean current I will flow between an electrode 2 and a water pipe 1. In that case, since the subterranean current I is high frequency current, the subterranean current I of the value decided by the capacitance C4, C5, and C6 of the concrete layer 13 and the earth 3 etc. flows. Therefore, this subterranean current I flows, even if water is not leaking in the water pipe 1. If water leaked in the water pipe 1, for example, the field [being

scattered] 12 has absorbed water, since capacitance C6 will become large on the other hand, the subterranean current I judges with that to which water is leaking in increase and the leakage-of-water detector 7, and takes out an information signal.

[0036] Moreover, in drawing 6 , AC power supply 6 and the leakage-of-water detector 7 may be loaded into an automobile like drawing 1 , and may press an electrode 2 as tire 5A of the automobile is also. It is allotted to the location from which the electrode 2 separated from right above the water pipe 1 with the configuration of drawing 6 . If the field 12 of leakage of water should be restricted only under the water pipe 1 like drawing 3 and the electrode 2 is arranged right above the water pipe 1, the subterranean current I may hardly increase but the detection sensibility of leakage of water may worsen. If the electrode 2 is arranged on the location from which it separated from right above the water pipe 1, since capacitance C6 becomes large, the detection sensibility of leakage of water will not worsen. Moreover, even if water leaks in right above a water pipe 1, since capacitance C4 becomes large, the detection sensibility of leakage of water does not worsen. In addition, even if the water pipe 1 of drawing 6 is a metallic conduit, and it is the insulating tube, it is not cared about.

[0037] Drawing 7 is the sectional view showing the configuration of the leakage-of-water detection equipment of the water pipe concerning the example from which this invention differs further. The water pipe 1 was laid under the earth 3, and branch pipe 1A of this water pipe 1 is exposed from the concrete layer 4 of the front face of the earth 3. The metal bibcock 14 of a trailer is attached in this branch pipe 1A. The one side edge of lead wire 10 is connected to this metal bibcock 14. Moreover, the tabular electrode 2 is laid in the concrete layer 4, one outgoing end of AC power supply 6 is connected to this electrode 2, and the another side edge of lead wire 10 is connected to the outgoing end of another side of AC power supply 6 through the current transformer 8 of the leakage-of-water detector 7. Others of drawing 7 are the same as the configuration of drawing 1 . By shifting the location of an electrode 2 one by one like the case of drawing 1 , the existence and its leakage-of-water location of the leakage of water of a water pipe 1 are detectable.

[0038] The example of drawing 7 is applied to the water pipe 1 of the diameter of a header which mainly supplies water to ordinary homes, and, in the case of the water pipe 1 of the diameter of macrostomia, the example of drawing 1 , drawing 2 , drawing 3 , drawing 5 , or drawing 6 is applied. Even if the water pipe 1 of drawing 7 is a metallic conduit and it is the insulating tube, it is not cared about. Moreover, the metal bibcock 14 may be the metal stop cock arranged on earth 3 front face. By [of lead wire 10] on the other hand connecting an edge, electric power can be supplied to the metal bibcock 14 or a stop-cock at the water in a water pipe 1.

[0039]

[Effect of the Invention] When the subterranean current which flows with this alternating voltage is measured and said subterranean current exceeds a predetermined value, by judging with that to which water is leaking in the water pipe, also in the case of pavement, the approach of this invention can detect leakage of water with sufficient sensibility, and can exclude the futility of the tap water by leakage of water, while fixed alternating voltage is impressed between the electrode in contact with the earth, and the water within a waterworks as mentioned above.

[0040] Moreover, in the approach of starting, even if just under a water pipe absorbs water at the time of leakage of water by being allotted to the location from which said electrode separated from right above the water pipe, the leakage of water of a water pipe can be detected and leakage of water can be detected more certainly. Moreover, in the approach of starting, sequential measurement of said subterranean current is carried out meeting and moving said electrode in the die-length direction of a water pipe, by judging with that to which water is leaking in the water pipe in the location where said subterranean current is the largest, standardization of the leakage-of-water location of a water pipe can be carried out, and leak-prevention measures can be taken quicker.

[0041] Moreover, the tabular electrode which is equipment which enforces the approach of starting and was laid on the surface of the earth, The lead wire with which the edge carried out electric conduction

contact with the water within a waterworks on the other hand, and the another side edge was pulled out on the ground through the manhole, The AC power supply which impresses alternating voltage between said electrodes and another side edges of said lead wire, While measuring the subterranean current which this AC power supply outputs, when a subterranean current exceeds a predetermined value, by being constituted in the leakage-of-water detector judged to be that to which water is leaking in said water pipe, the leakage of water of the water pipe of the diameter of macrostomia can be detected.

[0042] Moreover, the tabular electrode which is equipment which enforces the approach of starting and was laid on the surface of the earth, The lead wire in which an edge carries out electric conduction to contact on the other hand at the metal bibcock or the metallic stop cock of a water pipe, While measuring the subterranean current which the AC power supply which impresses alternating voltage between said electrodes and another side edges of said lead wire, and this AC power supply output, when a subterranean current exceeds a predetermined value, you may make it constituted by the leakage-of-water detector judged to be that to which water is leaking in said water pipe. The leakage of water of the water pipe of the diameter of a header which supplies water to home use is detectable with it.

[0043] Moreover, in this configuration, the activity which detects a leakage-of-water location becomes easy by loading said AC power supply and said leakage-of-water detector into an automobile. Moreover, in this configuration, by making the tire of an automobile run aground on said electrode, the measurement value of a subterranean current is stabilized and measurement precision improves.

[Translation done.]

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1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.*** shows the word which can not be translated.

3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The sectional view showing the configuration of the leakage-of-water detection equipment of the water pipe concerning the example of this invention

[Drawing 2] It is the side elevation in which it is drawing showing the configuration of the leakage-of-water detection equipment of the water pipe concerning the example from which this invention differs, and the sectional view in which (A) shows the configuration of the whole leakage-of-water detection equipment, and (B) show the configuration of the electrode rise-and-fall section.

[Drawing 3] The side elevation showing the configuration of the electrode rise-and-fall section in the leakage-of-water detection equipment of the water pipe concerning the example from which this invention differs further

[Drawing 4] The property diagram at the time of carrying out standardization of the leakage-of-water location of a water pipe using the equipment of drawing 1 thru/or drawing 3

[Drawing 5] The block diagram showing the configuration of the part carried in the automobile in the leakage-of-water detection equipment of the water pipe concerning the example from which this

invention differs further.

[Drawing 6] The sectional view showing the configuration of the leakage-of-water detection equipment of the water pipe concerning the example from which this invention differs further

[Drawing 7] The sectional view showing the configuration of the leakage-of-water detection equipment of the water pipe concerning the example from which this invention differs further

[Description of Notations]

1: The water pipe, 2, 2A:electrode, 3:earth, 5:automobile, 5A:tire, 6:AC-power-supply, 7, and 7A:leakage-of-water detector, 10:lead-wire, 11:manhole, 14:metal bibcock, 20, and 20A:electrode rise-and-fall section, 21, a 21A:guide, 22, a 22A:shaft, 23, a 23A:actuator, 24, a 22A:control unit, 27:wheel, 31:signal-processing section, 32 : display

[Translation done.]